Idaho, the region consisting mainly of rolling hills, destitute of trees and shrubs, and said to be quite typical of a large area in eastern Washington and western Idaho. These hills are generally called Palouse hills, and hence the title of the book. The manual certainly covers a region of very great interest in its unrivaled floristic riches. The keys and descriptions seem to be entirely adequate, and, checked as they have been by the large field experience of the authors, the manual must give as good a presentation of the flora as is possible at present. The nomenclature follows what are called the Kew and Berlin rules. Several new species are described, and the enumeration of species shows 14 pteridophytes, 9 gymnosperms, 114 monocotyledons, and 526 dicotyledons. The exceedingly varied conditions of the western mountain region will demand the publication of just such local manuals as this.—J. M. C.

THE LIVERPOOL Marine Biological Committee is doing good work in publishing short popular papers on the more interesting animals and plants in the general region of its activities, the Irish sea. The first three papers described animals, but the fourth, just issued, is on Codium,[6] a very interesting genus of the Siphonales. Following a general introduction, we have presented an account of the structure, reproduction, habits, and distribution of this alga. The life history is still incomplete in certain phases of reproduction. There are two forms of sporangia, one producing large green zoospores and the other small yellow elements, both however morphologically similar and biciliate. The larger green zoospores will germinate vegetatively, and the problems concern the fate and function of the small yellow bodies. They have been supposed to be sperms that should fuse with the green swarmers, but no unions have ever been observed. It is probable that the yellow zoospores are gametes, which under suitable condition will conjugate with one another. The authors of the paper suggest that the plant is becoming apogamous, a view that has support, further than the mere negative evidence, in the fact that the hypothetical gametangia at certain stages in their development may be reproductive. They are then adventitious buds, capable of growing out in a branching filament, which however appears to remain attached to the parent plant. The paper is illustrated with three very clear plates.—B. M. DAVIS.

NOTES FOR STUDENTS.

THE POLLEN tube in *Cucurbita Pepo* according to B. Longo[7] traverses the tissues of the funiculus and outer integument before entering the

[6] GIBSON and AULD: Codium. pp. viii + 18. *pls. 3*. L. M. B. C. Memoirs. IV. 1900.

[7] La mesogamia nella commune zucca (*Cucurbita Pepo* Linn.). Rendiconti della R. Accademia dei Lincei **10**: 168–172. 1901.

micropyle. The writer proposes the name *mesogamy* for this phenomenon.—CHARLES J. CHAMBERLAIN.

DR. N. WILLE[8] has begun a series of studies on the Chlorophyceae. The first paper contains numbers one to seven, and treats of the structure and phases in the life histories of *Sybidion Droebakense*, n. sp., Trochiscia, *Prasiola crispa*, *Ulothrix flacca* and several new species of Ulothrix, Pseudendoclonium, nov. gen., and certain species of Rhizoclonium. Four excellent plates accompany the text.—B. M. DAVIS.

AS A RESULT of experiments conducted in Maryland in the seasons of 1899 and 1900, C. O. Townsend finds[9] that celery blight, caused by the fungus *Cercospora apii*, can be prevented by the use of fungicides. The best results, apparently, are given by ammoniacal solution of copper carbonate, Bordeaux mixture being equally good as a fungicide but causing a slight stunting of the plants. To obtain the best results the first application should be made while the plants are still in the seed-bed, followed by other applications every week until cool weather, which checks the progress of the disease. —ERNST A. BESSEY.

THE SUBJECT of oat smut has received attention in two recent bulletins from the Illinois[10] and Wisconsin[11] experiment stations respectively. In both an estimate is given as to the annual loss in the state from this smut, about 14 per cent. for Illinois and about 6 per cent. for Wisconsin. The results of experiments with the hot water treatment at different temperatures are described in the former bulletin, the temperature found to be most efficient without injury to the germinative power of the grain being 135° F. for five minutes. Both bulletins discuss the formalin treatment, which is shown to be even more effective than that with hot water and somewhat more easy to perform. — ERNST A. BESSEY.

A SHORT NOTE on the abundant and destructive occurrence of the dwarf mistletoe, *Arceuthobium pusillum*, in the upper peninsula of Michigan is given in a recent bulletin from the Michigan Experiment Station.[12] In connection with the recent rediscovery of this interesting plant in New England, it is of

[8] WILLE, DR. N.: Studien über Chlorophyceen. Med. f. d. biol. sta. v. Dröbak. no. 2. 1901.

[9] TOWNSEND, C. O.: Notes on celery blight. Bull. Maryland Agr. Exp. Sta. no. 74. pp. 167–182. *figs. 1–7*. May 1901.

[10] SHAMEL, A. D.: Treatment of oats for smut. Bull. Ill. Agr. Exp. Sta. no. 64, pp. 57–72. *6 pls.* Urbana. March 1901.

[11] GOFF, E. S.: The prevention of oat smut. Special Bulletin, Wisconsin Agr. Exp. Sta. pp. 1–4. *fig. 1*. Madison. March 1901.

[12] WHEELER; C. F.: The geology and botany of the Upper Peninsula Experiment Station. Report of the Upper Peninsula Experiment Station for the year 1900. Bull. Michigan Agr. Exp. Sta. no. 186. pp. 17–28. *4 pls.* Dec. 1900.

interest to note that in Michigan it is in some places so abundant as to kill out nearly every tree. The parasite itself is attacked by a fungus, *Wallrothiella arceuthobii* Peck, which apparently serves to keep it in check somewhat. In the same bulletin are given notes on the trees and a list of the flowering plants growing on the station farm, as well as a list of the few of the commoner diseases of cultivated plants observed there.—ERNST A. BESSEY.

D. T. MACDOUGAL[13] has studied the bulbils which are formed in the axils of the aerial stems of *Lysimachia terrestris*, and regards them as representing a new category of propagative bodies. They are branches of restricted development, and are formed under conditions unfavorable for seed formation, diffuse light and low temperature apparently being the principal inciting causes. They are free from transpiratory organs of any kind, and resemble rhizomes in structure rather than aerial stems upon which they are borne. The "germination" of the bulbil occurs without any appreciable resting period, and is followed by the final stages of the differentiation of the stele, which was checked during the formation of the bulbil. The bulbil becomes the main axis of the new plant, and does not perish, except gradually, after the manner of a rhizome, into which it becomes converted.—J. M. C.

MUSHROOMS ARE DISCUSSED in two recent Experiment Station bulletins, one from Idaho[14] and the other from North Carolina.[15] Both give rules for avoiding poisonous fungi and analyses showing the food value of the edible species. This has been greatly overrated, for, compared with other foods, these fungi have not only a small heating power but have also a low nitrogen content. In the former bulletin a few species are popularly described with the aid of good half-tone plates, while in the bulletin from North Carolina all or nearly all of the edible species reported in the state are described, rather too technically it would seem. This technicality, combined with the lack of illustrations, leads one to fear that it will not be serviceable as a popular guide. The glossary, five pages in length, is no doubt necessary but might have been made more accurate. The definition of basidia as "cellular processes of certain mushroom-bearing spores" is probably a typographical error, but is plainly very misleading as it stands.—ERNST A. BESSEY.

THE THIRD EDITION of Sturgis's *Literature of Plant Diseases*[16] brings the

[13] Propagation of *Lysimachia terrestris*. Bull. N. Y. Bot. Garden **2**: 82–89. 1901.

[14] HENDERSON, L. F.: Mushrooms or toadstools: a natural food product. Bull. Idaho Agr. Exp. Sta. no. 27. pp. 27–54. *figs. 1–12.* Moscow. March 1901.

[15] HYAMS, C. W.: Edible mushrooms of North Carolina. Bull. N. C. Agr. Exp. Sta. no. 177. pp. 25–58. West Raleigh. Dec. 1900.

[16] STURGIS. W. C., Literature of plant diseases. A provisional bibliography of the more important works published by the U. S. Department of Agriculture and the agricultural experiment stations of the United States from 1887 to 1900 inclusive, on fungous and bacterial diseases of economic plants. Rep. Conn. Agr. Exp. Sta. for year ending Oct. 31, 1900. Part III. pp. 255–297. 1901.

bibliography of these diseases nearly up to date. The first edition appeared in 1893 and the second in 1897. It does not assume to be a complete bibliography, but a reference list "to enable the practical observer of plant diseases to ascertain what are the principal sources of information regarding the specific cause of a certain disease and the method of prevention as recorded in the publications of our own Department of Agriculture and of the various state experiment stations." As in the previous editions, the host plants are arranged alphabetically under their common names. A number of diseases formerly ascribed to parasitic organisms but since shown to be due to other causes are omitted, while many new host plants whose diseases have been studied in this country only in recent years are added, making the list now somewhat longer than before. The work is exceedingly useful not only to the practical worker but also to the specialist.—ERNST A. BESSEY.

THE ZYGOSPORE OF SPORODINIA was studied six years ago by Léger, who found that both gametes contain hundreds of small nuclei which become scattered in the mingling cytoplasm when the membrane separating the gametes breaks down. The nuclei near the periphery are much smaller than those nearer the center. At a later stage all the nuclei disappear, and at each pole of the zygospore there is found an "embryonic sphere" containing a large number of granules. The spheres increase in size and fuse with each other, and soon afterward numerous nuclei again appear. Gruber[17] has examined Sporodinia, and he also finds a large number of nuclei in the zygospore. The nuclei are more numerous at the periphery, but those at the periphery and those at the center are approximately alike in size. This condition persists for a long time, and subsequent stages were hard to follow. No fusion, division, or disorganization of nuclei could be established with any certainty. The presence of "embryonic spheres" is regarded as doubtful. On germination the nuclei appear in greater numbers and pass into the germ tube. Although the writer was not able to observe any fusion of nuclei, he believes that a fusion of nuclei at the center of the zygospore is very probable. —CHARLES J. CHAMBERLAIN.

THE EFFECT of fungicides upon the foliage of the peach is discussed by W. C. Sturgis in a recent report of the Connecticut Agricultural Experiment Station.[18] The experiments were made with various strengths of Bordeaux mixture, with a soda-Bordeaux, in which soda replaced the lime, with ammoniacal solution of copper carbonate, with copper acetate, and with potassium sulfid. The Bordeaux mixture was found to be injurious to the

[17] GRUBER, EDUARD: Ueber das Verhalten der Zellkerne in den Zygosporen von *Sporodinia grandis* Link. Ber. d. deutsch. bot. Gesell. **19**: 51–55. *pl.* 2. 1901.

[18] STURGIS, W. C.: Peach-foliage and fungicides. Report of the Connecticut Agricultural Experiment Station for the year ending October 31, 1900. Part III, pp. 219–254. *pls.* 3–5. 1901.

foliage except when very weak solutions were used. The soda-Bordeaux was also injurious, as was the ammoniacal solution of copper carbonate. Potassium sulfid, however, proved to be harmless, and at the same time to be a fairly good fungicide. Normal copper acetate solution was harmless but the subacetate caused injury. Careful comparative examinations of leaves of plants susceptible to injury by copper-containing fungicides, viz., peach, Japanese plum, and apricot, with leaves of plants not so injured, viz., European plum, apple, cherry, quince, and pear, failed to reveal any constant difference in the thickness of the leaves as a whole, or of the epidermis and the different layers of tissue, or in the size or number of the stomata. The susceptible leaves, however, had a very dense spongy parenchyma, with small intercellular spaces, while the non-susceptible leaves had this tissue very loose in texture.— ERNST A. BESSEY.

CLEISTOGAMOUS FLOWERS[19] are found in nearly all violets, but are especially typical in *Viola odorata*. The normal flower which appears early in the spring has a handsome corolla, but it seldom produces good seed. The inconspicuous cleistogamous flowers which come later, usually after the normal flowers have disappeared, produce an abundance of good seed. The stamens are larger in the normal flowers than in the cleistogamous, but the size of the pollen grains is about the same in both. The structure of the anther wall is quite different, the normal anther having the usual endothecium with lignified thickenings, while in the cleistogamous flower the endothecial layer retains its nucleus and cytoplasm.

After the pollen is mature there is a resting period of various duration. Pollen tubes are then put out which penetrate the wall of the anther at its upper part where there is a region of small cells rich in protoplasm, a tissue comparable to the conductive tissue of the style. *Oxalis acetosella*, *Linaria spuria*, and *Leersia oryzoides* were also studied.

In typical cleistogamous flowers the pollen germinates within the pollen sac, and the structure of the anther wall is modified to meet the new mode of pollination. In Linaria and Leersia, where the pollen was not observed to germinate within the pollen sac, the anther wall has the same structure as in the normal flower.— CHARLES J. CHAMBERLAIN.

BULLETINS from the experiment stations of interest to botanists, and not heretofore mentioned in these pages, are as follows: A. S. HITCHCOCK and G. L. CLOTHIER (Kans. no. 87, pp. 29) write upon the "Native agricultural grasses of Kansas," with many illustrations and charts of distribution. H. GARMAN writes on the agricultural grasses of Kentucky, with some fine reproductions from photographs, and A. M. PETER supplies some chemical analyses, the two articles forming one bulletin (Ky. no. 87, pp. 68, *pl. 14*).

[19] DU SABLON, LECLERC: Recherches sur les fleurs cléistogames. Revue Générale de Botanique **12**: 305–318. *11 figs.* 1900.

F. A. WAUGH (Vt. no. 67, pp. 30) discusses hybridity among cultivated plums, and gives a systematic account of hybrid forms. Interesting trees of Vermont are described and figured by ANNA M. CLARK (Vt. no. 73, pp. 52), and those of Wyoming by AVEN NELSON (Wy. no. 40, pp. 52). W. W. ASHE (N. C. no. 175, pp. 8) gives technical diagnoses of 21 new species *Crataegus* and 8 new species of *Panicum*. E. E. BOGUE publishes "An annotated catalogue of the ferns and flowering plants of Oklahoma" (Okla. no. 45, pp. 48), D. A. SAUNDERS does the same for South Dakota (S. D. no. 64, pp. 127), and HENRY L. BOLLEY and L. R. WALDRON do the same for North Dakota (N. D. no. 46, pp. 91), all excellent beginnings toward complete floras of the respective states. C. F. WHEELER writes about the dwarf mistletoe in Michigan, with good reproductions from photographs, and on other topics (Mich. no. 186). L. H. PAMMEL describes the horse nettle (*Solanum Carolinense*), bind weed (*Convolvulus arvensis*), and ground burnut (*Tribulus terrestris*) as troublesome weeds in Iowa (Ia. no. 42.) D. A. BRODIE (Wash. no. 45, pp. 12) gives facts establishing the poisonous nature of the Oregon water-hemlock (*Cicuta vagans*).—J. C. ARTHUR.

FERTILIZATION IN *Ginkgo biloba* has recently been studied by Ikeno,[20] who gives a detailed account of phenomena from the cutting off of the ventral canal cell to the first division of the nucleus of the oospore. The nucleus of the ventral canal cell rapidly disorganizes, but in one instance it had enlarged *pari passu* with the nucleus of the oosphere. In preparations stained with methyl blue and acid fuchsin, the metaplasmic ground substance of the nucleus stains red, and the chromatin, which forms a small, irregular, granular mass, also takes the red, while the nucleoli stain blue. The nucleus then undergoes a great change in structure, so that the metaplasm and chromatin can no longer be distinguished from each other. The further development of the nucleus of the oosphere agrees with the description of the corresponding phenomena in *Pinus Laricio* as described by the reviewer in 1899. The tube nucleus and the nucleus of the stalk cell disorganize within the pollen tube and do not enter the oosphere, and it is very probable that only one of the male cells is discharged, the other disorganizing without being able to enter. The nucleus of the male cell slips out from the cytoplasm mantle before fusing with the nucleus of the oosphere. The mode of fusion is like that already described for *Cycas revoluta*, that is, the male nucleus gradually penetrates the egg nucleus before losing its own membrane. At the time of fusion the sex nuclei are very unequal in size, the female being about ten times as large as the male. The behavior of the chromatin during fusion is not described. The spindle in the first division of the fusion nucleus is very broad and multipolar, and is never parallel with the longitudinal axis of the

[20] Contribution à l'étude de la fécondation chez le *Ginkgo biloba*. Ann. Sci. Nat. Bot. VIII. **13**: 305–318. *pls. 2–3.* 1901.

oospore. In the case figured the spindle is transverse. Fertilization occurs while the ovules are still on the tree.—CHARLES J. CHAMBERLAIN.

DOUBLE FERTILIZATION in *Zea Mays*, which has been suspected for some time, and which is believed to be the cause of xenia, is described in a recent paper by Guignard.[21] The mature pollen grain contains, besides the vegetative nucleus, two very small elongated male cells, each in the form of a slender rod, curved or straight, and the ends often pointed. The cytoplasm of these cells is much reduced and difficult to distinguish, and their nuclei appear almost homogeneous. The synergids and oosphere are large, the former showing near the tip a conspicuous longitudinal striation, especially in material fixed in absolute alcohol. The nucleus of the oosphere is very large and contains much chromatin, and the cytoplasm is usually highly granular and much massed together at the time of fertilization. Near the oosphere, sometimes in the median plane, sometimes near the side of the embryo sac, are the two polar nuclei which do not fuse before fertilization, and have relatively large nuclei and a small amount of chromatin. As many as a dozen multinucleate cells may be found in the much narrowed antipodal end of the embryo sac. The pollen tube, after penetrating the embryo sac, usually seems to discharge its contents into one of the synergids. In one instance, the two elongated male cells were observed resting against the base of a synergid; under high magnification their chromatin was distinct. One of the male cells unites with the oosphere, the other with the polar nuclei, which it binds together. Fertilization proceeds with such great rapidity that it could be observed in very few preparations. In general, the ovules at the base of the ear are first fertilized, and in hybrids many ovules are not fertilized. After fertilization one of the synergids usually persists for a time, with the contents finely granular and refractive. Division of the definitive nucleus proceeds so rapidly that the author was not able to follow the course of cell division. The first two nuclei of the endosperm are large, each one having an enormous nucleolus and many smaller nucleoli. It is to be regretted that no figures are given.—W. J. G. LAND.

THE EMBRYOLOGY of the Balanophoraceae presents many puzzling peculiarities. Accounts are somewhat divergent, but whether the divergence is due entirely to variation in the processes still remains to be seen. Writers agree that there is no ovule or placenta in Balanophora but that the megaspore is situated in a tissue at the base of a prolongation incorrectly termed a "style." Van Tieghem (1896) found that in *B. indica* the polar nuclei do not fuse and that fertilization occurs at the antipodal end of the sac as often as at the upper end.

According to Treub (1898) in *B. elongata* the megaspore germinates in the usual manner. The polar nuclei, however, do not fuse but each divides

[21] La double fécondation dans le mais. Jour. Bot. **15**: 1–14. 1901.

independently. The egg apparatus breaks down and there is no fertilization, but an embryo develops from one of the cells of the endosperm. Lotsy (1899) investigated *B. globosa* and supported Treub in every particular, including the peculiar origin of the embryo.

Chodat and Bernard have recently investigated *Helosis guayanensis*.[22] The archesporial cell becomes the megaspore directly without cutting off a tapetal cell or giving rise to a row of potential megaspores.

The jacket or "tapetum" surrounding the embryo sac is sporogenous tissue. The two daughter nuclei resulting from the first division of the nucleus of the megaspore are quite different in appearance, the one at the upper end of the sac staining much more deeply. This nucleus gives rise to the egg, two synergids, and a polar nucleus in the usual manner. The other nucleus stains faintly and rarely divides at all, but soon degenerates so that no antipodals or polar nucleus are formed. According to Van Tieghem, the egg is fertilized in Helosis and Balanophora.

The present writers find that in Helosis the egg becomes large, but also becomes very weak and feeble in appearance, so that while they were not able to prove or disprove the occurrence of fertilization, they believe that the feeble condition of the egg together with the position of the embryo in the endosperm favor Treub's view that the embryo arises apogamously from the endosperm.—CHARLES J. CHAMBERLAIN.

ITEMS OF TAXONOMIC interest are as follows: E. P. BICKNELL (Torreya **1**: 25–28. 1901) has described a new Triosteum (*T. aurantiacum*) from the northeastern United States.—*Pl. Bakerianae* **2**: 1–42. 1901 contains Baker's collection of 1899, from fungi to grasses. Numerous new fungi are described by F. S. EARLE.—ALICE EASTWOOD (Bull. Torr. Bot. Club **28**: 137–160. *pls. 15–20.* 1901) has published upon some small-flowered species of Nemophila from the Pacific coast, describing twenty-six new species.—M. A. HOWE (*idem* 161–165) has described a new Riccia from Georgia.—E. P. BICKNELL (*idem* 166–172) has revised the eastern species of Teucrium, recognizing six species and describing four as new.—P. A. RYDBERG (*idem* 173–183), in further studies of the Potentilleae, describes new species of Potentilla (8), Horkelia, and Drymocallis.—W. A. SETCHELL (Zoe **5**: 121–129. 1901), in his "Notes on Algae," has described two new genera of Laminaceae (*Hedophyllum* and *Pleurophycus*) and a new genus of Dumontiaceae (*Weeksia*), besides several new species in other genera.—A. ENGLER (Bot. Jahrb. **36**: 29–126. 1901), in his 21st contribution to the African flora, presents the following papers: Fungi by P. HENNINGS, who describes numerous new species and two new genera, *Fistulinella* (Polyporaceae) and *Lactariopsis* (Agaricaceae); Algae by W. SCHMIDLE; a revision of Schrebera (Oleaceae) by E. GILG;

[22] CHODAT, R., and BERNARD, C.: Sur le sac embryonnaire de l'Helosis guayanensis. Jour. de Botanique **14**: 72–79. *pls. 1–2.* 1900.

Leguminosae by H. HARMS, *Scorodophloeus*, *Rhynchotropis*, and *Schefflerodendron* being new genera; Myrsinaceae by E. GILG; Amarantaceae by G. LOPRIORE, *Argyrostachys* being a new genus; Acanthaceae by G. LINDAU; Caricaceae by I. URBAN, *Cylicomorpha* being a new genus; and Gramineae by R. PILGER.—CARL MEZ (*idem* Beibl. **30**: 1–20. 1901) has described numerous new species of Bromeliaceae and Lauraceae.—I. URBAN (*idem* 27–38) continues his papers on new American plants.—A. ENGLER (*idem* 42) has described a new genus of Araceae (*Protarum*) from the Seychelles.—B. D. GILBERT (Fern Bulletin **9**: 27. 1901) has described a new variety of *Botrychium ternatum* (*Oneidense*) from central New York.—ACHILLE FORTI (Ber. deut. bot. Gesell. **19**: 6–7. 1901) has published a new genus (*Heteroceras*) of marine Peridineae.—W. SCHMIDLE (*idem* 20–24) has described a new genus (*Coccomyxa*) of the Protococcoideae.—C. S. SARGENT (Rhodora **3**: 71–79. 1901) has described six new species of Crataegus from the Province of Quebec near Montreal.—G. P. CLINTON (*idem* 79–82) has described two new smuts on *Eriocaulon septangulare*.—E. L. GREENE (*idem* 83–84) has segregated from *Eupatorium ageratoides* the bulk of the New England and northern forms that pass under that name, and called the species *E. boreale*.—C. DE CANDOLLE (Bull. Herb. Boiss. II. **1**: 353–366. 1901) has published an account of the Brazilian Piperaceae and Meliaceae collected by W. Schwacke, including descriptions of numerous new species.—R. CHODAT (*idem* 395–442), in continuing his account of the Hassler collection from Paraguay, has described numerous new species in various families.—W. TRELEASE (Rep. Mo. Bot. Gard. **12**: 77. *pl. 34*. 1901) has described a new cristate variety of *Pellaea atropurpurea* from Missouri.—J. W. TOUMEY (*idem* 75–76. *pls. 32–33*) has described a new Agave from Arizona. H. M. RICHARDS (Bull. Torr. Bot. Club **28**: 257–265. *pls. 21–22*. 1901) has described a new genus *Ceramothamnion*) of red algae from Bermuda.—P. A. RYDBERG (*idem* 266–284) has published a fifth fascicle of new species from the Rocky mountain region, among them being *Piperia*, a new genus of orchids.—J. K. SMALL (*idem* 290–294) has published a third paper on the shrubs and trees of the southern states, including a revision of the southeastern species of *Ptelea*.—In Torreya (**1**: 54–55. 1901) J. K. SMALL has published a new *Cornus* from Kentucky, and N. L. BRITTON a new *Crataegus* from Washington.—F. LAMSON-SCRIBNER and E. D. MERRILL (Rhodora **3**: 93–128. 1901) have published a revision of the New England species of *Panicum*, recognizing thirty-five species.—J. K. SMALL (Bull. N. Y. Bot. Garden **2**: 89–101. 1901) has published a synopsis of the Mimosaceae of the southeastern United States. He recognizes fourteen genera, and among them *Siderocarpos* and *Havardia* have been separated from Pithecolobium as new.—M. A. HOWE (*idem* 101–105. *pl. 14*) has published an enumeration of the liverworts collected in the Yukon Territory by R. S. Williams in 1898–9, including a new species of

Scapania. MR. WILLIAMS himself (*idem* 105–148. *pls. 15–24*) has enumerated the mosses, including a new genus (*Bryobrittonia*) closely related to Tortula and Desmatodon, and a number of new species. L. M. UNDERWOOD (*idem* 148–149) enumerates the pteridophytes; while the seed plants are presented by N. L. BRITTON and P. A. RYDBERG (*idem* 149–187), numerous new species being described.—P. A. RYDBERG (*idem* 187–233 *pls. 25–33*) has given an account of the oaks of the continental divide north of Mexico, recognizing twenty-nine species, nine of which are new.—J. M. C.

PROFESSOR A. B. MACALLUM[23] has recently added an interesting contribution to the cytology of certain so-called non-nucleated organisms. His work is divided into three parts, each dealing with a separate group of low organisms—the Cyanophyceae, Beggiatoa, and the yeast cell—and was undertaken with the hope of throwing some light on the origin of the cell nucleus, and to obtain data to determine the morphological character of the primal life organism. In his investigations Macallum not only used the ordinary cytological methods, but microchemical tests were also employed to advantage. Picric acid and corrosive sublimate afforded the best results as fixing fluids. The stains that gave the best differentiation were Ehrlich's and Delafield's haematoxylin, Czokor's alum cochineal, saffranin, eosin, picro-carmin, and methylen-blue. The microchemical methods employed for obtaining the reactions for "masked iron" were practically the same as those used in his earlier work published in 1896. The iron liberated by sulfuric acid alcohol was converted into Prussian blue, the trichomes were then stained with a picro-carmin solution for twenty-four hours, when the cyanophycin granules acquired a deep red color which contrasts markedly with the Prussian blue tint of the iron-holding granules. The results obtained on the Cyanophyceae are briefly as follows. The cell consists of two portions, the central body and the peripheral zone holding the pigment. There is no evidence of the presence of a special chromatophore. There are two types of granules present in the cell. The one stains with haematoxylin, contains "masked iron" and organic phosphorus, and therefore resembles chromatin. The other type is found in the peripheral layer, and chiefly adjacent to the cell membrane. It stains with picro-carmin, and is free from organic phosphorus and "masked iron." It is probably a proteid. There is no nucleus or any structure which resembles a nucleus in the Cyanophyceae. In Beggiatoa there is no differentiation of the cytoplasm into a central body and a peripheral layer, such as Bütschli describes. The compounds of "masked iron" and organic phosphorus are uniformly diffused throughout the cytoplasm in the threads. In the "spirilla," "comma," and "coccus" forms the cytoplasm shows characters like those of the threads, but there are also granules present

[23] On the cytology of non-nucleated organisms. University of Toronto studies. Physiological series 2. 1900.

which give a slight reaction for "masked iron" and organic phosphorus, and therefore are considered analogous to chromatin. No specialized chromatin-holding structure in the shape of a nucleus was found in any of the forms of Beggiatoa studied. In his studies on the yeast cell, Macallum finds that the cytoplasm takes a stain with haematoxylin and gives a diffuse reaction for "masked iron" and organic phosphorus. In addition to the chromatin-like substance diffused throughout the cell, there is usually present a homogeneous corpuscle. This is not considered to be a nucleus, although held to be such by other investigators. The chromatin-like substance in Saccharomyces is soluble in artificial gastric juices, thus differing from the chromatin of the higher plant and animal cells. The paper is illustrated by a colored lithographic plate. It is a valuable and highly interesting addition to the literature of this important problem.—A. A. LAWSON.